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10/597,874	08/10/2006	Thomas Blaffert	PHDE040045US	7335

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EXAMINER	
PATEL, NIRAV G	
ART UNIT	PAPER NUMBER
2624	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/597,874	BLAFFERT ET AL.	
	Examiner	Art Unit	
	Nirav G. Patel	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 December 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/14/2010 has been entered.

Response to Arguments

2. Applicant's arguments filed 12/14/2010 have been fully considered but they are not persuasive.

It appears from the applicant's remarks that there are some ambiguities in the examiner's interpretation/explanation and the applicants review. To help correct this, the examiner believes it would be beneficial to address the response that was issued in the Final Office Action dated 7/27/2010. During the response to the Non-Final Office action, the applicants submitted remarks on 6/7/2010, which indicated that the other constituents (sternum, trachea, vertebrae) of Ko are not relevant to the predetermined task of trend control of lung tumors. In response, the examiner indicated that the predetermined task of Ko is identifying lung nodules and that the registration of the trachea, sternum and vertebrae are relevant to the predetermined task of identifying lung nodules because it makes the process of identifying the lung nodules efficient (relevance is that the process is efficient). Moving forward to the recent remarks made

by applicants (12/14/2010), the assertion that the predetermined task was construed to be the image registration itself is incorrect, as evidenced by the original response in the Office Action dated 7/27/2010 and the response provided above. Furthermore, the applicants remark that the only object constituent that is relevant to that predetermined task is the patient's lungs and the detected nodules within the lungs (Response filed 12/14/2010, Page 5, "Independent Claims 1 and 9"). It is submitted by the examiner that the claim does not require that the object constituent that is relevant to the predetermined task is the patient's lung and nodules. As such, the examiner is taking a broad and reasonable interpretation that the limitation requiring that registering "…only those image areas associated with object constituents which are relevant to the predetermined task…" allows objects which are pertinent or connected with the matter in hand, to be registered. The rejection relies on Ko and his teachings to register images which depict the trachea independently in each image. These are considered relevant as it is pertinent to the identification of lung nodules as finding the trachea locates the lung and thus allowing for identification of the lung and nodules (see Figure 3). As such, the rejection is maintained.

Regarding claim 18, the applicants assert that the portion of Ko cited in the rejection of claim 18 discusses a user manually identifying lung apices in an image such that selection is done with consideration of the image, which is opposite of the claim language.

In the remarks filed 12/17/2009, Page 6, the applicants indicated that the selection of the which object constituents to be registered is performed without any of

the imaging data. Taking this into consideration, it is submitted that locating the structures which are subsequently identified has been predetermined (without consideration of both images). In other words, Ko has determined which objects need to be identified to perform the registration, in this case lung apices, which are then identified by the user during the process. As such, it is believed that Ko continues to read on the limitations of the claim, thus the rejection is maintained.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 9 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Ko et al. ("Chest CT: Automated Nodule Detection and Assessment of Change over Time-Preliminary Experience," "Ko").

1) Regarding Claim 1, Ko teaches a data processing unit for registering a first image and a second image of an object in order to perform a predetermined task with the registered images (Page 267, Col. 2, Lines 31-39: The system detects pulmonary nodules within CT images, thus the predetermined task is detecting nodules within the lung), the data processing

unit being set up to: segment the images automatically into various object constituents (Page 269, Cols 1, 2, & 3, Sections titled "Thorax and lung border detection," "Lung border correction and parenchymal detection": The system automatically determines the locations of the lungs and thorax (which includes the trachea) and then continues to find their boundaries from the volume of the acquired data, and isolating them, seen in Figure 2, thus segmenting the image into various object constituents);

register only those image areas associated with object constituents which are relevant to the predetermined task, wherein the object constituents to be registered are selected independently from the first image and the second image (Page 270, Col. 1, Section titled "Analysis of consecutive CT sections with three-dimensional techniques": Using images that depict trachea (object constituent which was automatically segmented, see previous limitation), the centroids are calculated and used to register the images, thus the centroid of the trachea (object constituent) is registered, the trachea relevant to identifying the nodules within the lung as it helps identifying the lung (where the nodules are located). These centroids are selected independently as the trachea is selected in each image, and then registered).

2) Regarding Claim 9, Ko teaches a method for registering a first image and a second image of an object in order to perform a predetermined task with the registered images, comprising the following steps: automatic segmentation of the images into various object constituents (Page 269, Cols 1, 2, & 3, Sections titled "Thorax and lung border detection," "Lung border correction and parenchymal detection": The system automatically determines the locations of the lungs and thorax and then continues to find their boundaries from the volume of the acquired data, and isolating them, seen in Figure 2, thus segmenting the image into various object constituents);

registration of the image areas associated with object constituents relevant to the predetermined task, wherein the object constituents to be registered are selected

independently from the first image and the second image (Page 270, Col. 1, Section titled "Analysis of consecutive CT sections with three-dimensional techniques": The images that depicted the trachea (constituent relevant to the task), the centroids were calculated and registered from images, which is independently, as the trachea is selected in each image, and then registered).

3) Regarding Claim 18, Ko teaches a method for a user to use a data processing unit to register a first image and a second image of an object, the method comprising:

the user selecting one or more object constituents to be registered without consideration of the first image or the second image, the selected object constituents being relevant to a predetermined task, and the user inputting the selection into the data processing unit (Page 270, Col. 2, Lines 14-16: The computer vision system (data processing unit) needed to have lung apices identified manually. The need being interpreted as a requirement to be met that has been established, prior to any imaging be conducted/viewed. The apices are the constituents relevant to the predetermined task (apices found within the CT section), all which is inputted into the computer vision system);

the data processing unit being set up to automatically segment the first image and the second image into one or more object constituents, and then to register only the selected object constituents (Page 269, Cols 1, 2, & 3, Sections titled "Thorax and lung border detection," "Lung border correction and parenchymal detection": The system automatically determines the locations of the lungs and thorax and then continues to find their boundaries from the volume of the acquired data, and isolating them, seen in Figure 2, thus segmenting the image into various object constituents. Page 270, Col. 1, Section titled "Analysis of consecutive CT sections with three-dimensional techniques": The images that depicted the trachea within the lung region section (constituent relevant to

the task), the centroids were calculated and registered from images, which is independently, as the trachea is selected in each image, and then registered).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko in view of Sofia Totterman et al. (U.S. Pub. No.: 2003/0072479, "Sofia Totterman").

1) Regarding Claim 2, while Ko teaches the limitations of claim 1, he fails to explicitly teach registering the image areas of various object constituents using individually assigned registration methods.

However, in the same field of medical image analysis, Sofia Totterman teaches registering the image areas of various object constituents using individually assigned registration methods (Paragraph 69: the approach of the present invention takes into account the local deformations of soft tissues by using a priori knowledge (registration method) of the material properties of the different structures found in the image segmentation. Also, different strategies (registration methods) can be applied to the motion of the rigid structures and to that of the soft tissues to register the image areas).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the registration methods taught by Sofia Totterman in place of the registration step of Ko. The determination of obviousness is predicated upon the

following findings: one skilled in the art would have been motivated to modify Ko in this manner because segmenting images automatically, using individually assigned registration methods allows for the images to be grouped off so that another process or user may discard the groups which are considered irrelevant to the examination of the images or noise. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a “fundamental” operating principle of Ko, while the teaching of Sofia Totterman continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of performing image registration using individually assigned registration methods. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

2) Regarding Claim 10, while Ko teaches the limitations of claim 9, he fails to explicitly teach registering the image areas of various object constituents using individually assigned registration methods.

However, in the same field of medical image analysis, Sofia Totterman teaches registering the image areas of various object constituents using individually assigned registration methods (Paragraph 69: the approach of the present invention takes into account the local deformations of soft tissues by using a priori knowledge (registration method) of the material properties of the different structures found in the image segmentation. Also, different strategies

(registration methods) can be applied to the motion of the rigid structures and to that of the soft tissues to register the image areas).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the registration methods taught by Sofia Totterman in place of the registration step of Ko. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because segmenting images automatically, using individually assigned registration methods allows for the images to be grouped off so that another process or user may discard the groups which are considered irrelevant to the examination of the images or noise. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a “fundamental” operating principle of Ko, while the teaching of Sofia Totterman continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of performing image registration using individually assigned registration methods. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

7. Claims 3, 5, 6, 11, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko in view of Zhao et al. ("Directional Edge Registration for Temporal Chest Image Subtraction," Zhao").

1) Regarding Claim 3, while Ko teaches the limitations of claim 1, he fails to explicitly teach segmented object constituents are automatically classified.

However, in the same field of medical image analysis, Zhao teaches segmented object constituents are automatically classified (Part II, Section C: "Ribs extraction and Boundary detection," Lines 1 - 3: a set of rule base (reasoning) algorithms to identify rib edges was developed. The lung and heart boundaries were extracted using an invert umbrella filter. Both methods are automatic to classify objects and extract them).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the teachings of Zhao to classify the constituents after they are segmented by Ko. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because automatically classifying the segmented images provides an efficient way to take segmented images and determine if they contain wanted data or unwanted data. This would allow for a conclusion to be made of the data which has been segmented. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Zhao continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result

of analyzing segmented objects to generate a classification. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

2) Regarding Claim 5, while Ko teaches the limitations of claim 1, he fails to explicitly teach the limitations of claim 5.

However, in the same field of medical image analysis, Zhao teaches a first image and/or the second image are/is (a) two- or three-dimensional computer tomogram(s), in particular an X-ray photograph or a magnetic resonance image (Abstract: Temporal chest radiographs (2D X-ray) were used in a directional filtering technique).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the medical images that are acquired by Zhao, and then continue to perform the segmenting and registering steps as taught by Ko. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because acquiring 2D or 3D x-rays or magnetic resonance images (MRI) is a way to acquire images of a patient's internal organs which is not invasive. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a “fundamental” operating principle of Ko, while the teaching of Zhao continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of acquiring medical images that are either two- or

three-dimensional computer tomograms. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

3) Regarding Claim 6, while Ko teaches the limitations of claim 1, he fails to explicitly teach the limitations of claim 6.

However, in the same field of medical image analysis, Zhao teaches an object is the chest of a patient, the lungs being the object constituent relevant to a tumor diagnosis (Abstract: Normal chest structures (ribs, hear, and other normal lung structures) were reduced due to this technique, therefore the regions of the lung were tumors are present were not reduced).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to acquire images of a patient's chest which is then segmented as taught by Ko, and then registering the lungs in the patient's chest as those objects which are relevant to be registered. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because imaging the chest allows for the lungs of a patient to be imaged so that a diagnosis can be made concerning the presence of tumors. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Zhao continues to perform the same function as originally taught prior to

being combined, in order to produce the repeatable and predictable result of identifying lungs and nodules within acquired medical images. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

4) Regarding Claim 11, while Ko teaches the limitations of claim 9, he fails to explicitly teach segmented object constituents are automatically classified.

However, in the same field of medical image analysis, Zhao teaches segmented object constituents are automatically classified (Part II, Section C: "Ribs extraction and Boundary detection," Lines 1 - 3: a set of rule base (reasoning) algorithms to identify rib edges was developed. The lung and heart boundaries were extracted using an invert umbrella filter. Both methods are automatic to classify objects and extract them).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the teachings of Zhao to classify the constituents after they are segmented by Ko. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because automatically classifying the segmented images provides an efficient way to take segmented images and determine if they contain wanted data or unwanted data. This would allow for a conclusion to be made of the data which has been segmented. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Zhao continues to perform the same function as originally

taught prior to being combined, in order to produce the repeatable and predictable result of analyzing segmented objects to generate a classification. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

5) Regarding Claim 13, while Ko teaches the limitations of claim 9, he fails to explicitly teach the limitations of claim 13.

However, in the same field of medical image analysis, Zhao teaches one of the first image and the second image is a two- or three-dimensional computer tomogram (Abstract: Temporal chest radiographs (2D X-ray) were used in a directional filtering technique).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the medical images that are acquired by Zhao, and then continue to perform the segmenting and registering steps as taught by Ko. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because acquiring 2D or 3D x-rays or magnetic resonance images (MRI) is a way to acquire images of a patient's internal organs which is not invasive. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a “fundamental” operating principle of Ko, while the teaching of Zhao continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of acquiring medical images that are either two- or

three-dimensional computer tomograms. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

6) Regarding Claim 14, while Ko teaches the limitations of claim 9, he fails to explicitly teach the limitations of claim 14.

However, in the same field of medical image analysis, Zhao teaches an object is the chest of a patient, and the predetermined task is tumor diagnosis in a lung of the patient (Abstract: Normal chest structures (ribs, hear, and other normal lung structures) were reduced due to this technique, therefore the regions of the lung were tumors are present were not reduced).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to acquire images of a patient's chest which is then segmented as taught by Ko, and then registering the lungs in the patient's chest as those objects which are relevant to be registered. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because imaging the chest allows for the lungs of a patient to be imaged so that a diagnosis can be made concerning the presence of tumors. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Zhao continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of identifying

lungs and nodules within acquired medical images. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

8. Claims 4, 12, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko in view of Kawata et al. ("*Tracking interval changes of pulmonary nodules using a sequence of three-dimensional thoracic images*," "Kawata").

1) Regarding Claim 4, while Ko teaches the limitations of claim 1, he fails to explicitly teach a linear registration is performed on several resolution levels, rigid bodies being registered on a coarse grid followed by affine registration on a finer grid.

However, in the same field of medical image analysis, Kawata teaches a linear registration is performed on several resolution levels (Abstract Lines 1 – 2: a computerized approach to characterize pulmonary nodules through quantitative analysis between sequential 3-D thoracic images is developed), rigid bodies being registered on a coarse grid (Abstract Lines 2 – 3: the registration procedure of sequential 3-D pulmonary images consisted of two transformation steps: the rigid transformation step between two sequential 3-D thoracic CT image, which is on a coarse grid as the next step involves a finer grid) followed by affine registration on a finer grid (Abstract Lines 2 – 4: the registration procedure of sequential 3-D pulmonary images consisted of two transformation steps: the affine transformation step between two sequential region-of-interest (ROI) images including the pulmonary nodule, this is on a finer grid).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to perform the linear registration techniques taught by Kawata on the relevant object constituents which have been segmented by Ko. The determination of

obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because registering rigid bodies on a coarse grid allows for objects not of interest, such as ribs, arteries, veins and other irrelevant imaged bodies to be identified without the need to finely define their boundaries due to the fact that they are not of concern. Performing an affine registration on a finer grid allows for regions of interest to be registered with high level of accuracy so that a proper diagnosis can be made. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Kawata continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of performing registration on image medical data. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

2) Regarding Claim 12, while Ko teaches the limitations of claim 9, he fails to explicitly teach a linear registration is performed on several resolution levels, rigid bodies being registered on a coarse grid followed by affine registration on a finer grid.

However, in the same field of medical image analysis, Kawata teaches a linear registration is performed on several resolution levels (Abstract Lines 1 – 2: a computerized approach to characterize pulmonary nodules through quantitative analysis between sequential 3-D thoracic images is developed), rigid bodies being registered on a coarse grid (Abstract Lines 2 – 3: the registration procedure of sequential 3-D pulmonary images consisted of two transformation steps:

the rigid transformation step between two sequential 3-D thoracic CT image, which is on a coarse grid as the next step involves a finer grid) followed by affine registration on a finer grid (Abstract Lines 2 – 4: the registration procedure of sequential 3-D pulmonary images consisted of two transformation steps: the affine transformation step between two sequential region-of-interest (ROI) images including the pulmonary nodule, this is on a finer grid).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to perform the linear registration techniques taught by Kawata on the relevant object constituents which have been segmented by Ko. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because registering rigid bodies on a coarse grid allows for objects not of interest, such as ribs, arteries, veins and other irrelevant imaged bodies to be identified without the need to finely define their boundaries due to the fact that they are not of concern. Performing an affine registration on a finer grid allows for regions of interest to be registered with high level of accuracy so that a proper diagnosis can be made. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Kawata continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of performing registration on image medical data. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

3) Regarding Claim 16, while Ko teaches the limitations of claim 9, he fails to explicitly teach the registration is one of a rigid body transformation, an affine transformation, and a non-linear spline function.

However, in the same field of endeavor, Kawata teaches the registration is one of a rigid body transformation, an affine transformation, and a non-linear spline function (Abstract Lines 1-3: A computerized approach to characterize pulmonary nodules through quantitative analysis between sequential 3-D thoracic images is developed. The registration procedure of sequential 3-D pulmonary images consisted of two transformation steps: the rigid transformation step between two sequential 3-D thoracic CT images, which are on a coarse grid as the next step involves a finer grid).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to perform the registration of Ko's object constituents using the rigid body transformation as taught by Kawata. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because registering rigid bodies on a coarse grid allows for objects not of interest, such as ribs, arteries, veins and other irrelevant imaged bodies to be identified without the need to finely define their boundaries due to the fact that they are not of concern. Performing an affine registration on a finer grid allows for regions of interest to be registered with high level of accuracy so that a proper diagnosis can be made. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Kawata continues to perform the same function as originally

taught prior to being combined, in order to produce the repeatable and predictable result of performing a rigid body transformation on image data as a registration method. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

4) Regarding Claim 17, while Ko teaches the limitations of claim 1, he fails to explicitly teach the registration is one of a rigid body transformation, an affine transformation, and a non-linear spline function.

However, in the same field of endeavor, Kawata teaches the registration is one of a rigid body transformation, an affine transformation, and a non-linear spline function (Abstract Lines 1-3: A computerized approach to characterize pulmonary nodules through quantitative analysis between sequential 3-D thoracic images is developed. The registration procedure of sequential 3-D pulmonary images consisted of two transformation steps: the rigid transformation step between two sequential 3-D thoracic CT images, which are on a coarse grid as the next step involves a finer grid).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to perform the registration of Ko's object constituents using the rigid body transformation as taught by Kawata. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because registering rigid bodies on a coarse grid allows for objects not of interest, such as ribs, arteries, veins and other irrelevant imaged bodies to be identified without the need to finely define their boundaries due to the fact that they are not of concern. Performing an affine registration on a finer grid allows for regions of interest to be registered with high level of accuracy so that a proper diagnosis can be made. Furthermore, the prior art collectively includes each element claimed (though not

all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a “fundamental” operating principle of Ko, while the teaching of Kawata continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of performing a rigid body transformation on image data as a registration method. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

9. Claims 7, 8 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko in view of Kuhnigk (U.S. Pub. No.: 2005/0196024).

1) Regarding Claim 7, while Ko teaches the limitations of claim 1, he fails to explicitly teach segmentation is performed using a watershed transformation.

However, in the same field of medical image analysis, Kuhnigk teaches segmentation is performed using a watershed transformation (Paragraph 29: segmentation is performed by means of a watershed transformation).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to perform the segmentation step of Ko using the watershed transformation as taught by Kuhnigk. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because performing a segmentation using a watershed

transformation allows for segmentation based on topology, so that areas of interest are segmented properly and do not loose relevant information. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Kuhnigk continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of segmenting an medical image. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

2) Regarding Claim 8, while Ko teaches the limitations of claim 1, he fails to explicitly teach an imaging device for producing images of an object; and a data processing unit as claimed in claim 1, coupled to the imaging device.

However, in the same field of medical image analysis, Kuhnigk teaches an imaging device for producing images of an object (Paragraph 40: three dimensional lung image data is acquired by computer tomography, nuclear magnetic resonance tomography or by means of another image modality); and

a data processing unit as claimed in claim 1, coupled to the imaging device (Figure 2: Computer system 200 (data processing unit) is coupled to the image data acquisition system 202 (imaging device), also see analysis of claim 1, where Ko teaches the use of a computer vision system (Page 269, Col. 1, "Computer vision system"))).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to connect a medical imaging device, as taught by Kuhnigk, to the data processing unit of Ko such that images can be acquired and processed. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because using an imaging device such as nuclear magnetic resonance or computer tomography allows for an image of chest region of a patient to be produced. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Kuhnigk continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of acquiring medical images which are processed by a computer. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

3) Regarding Claim 15, while Ko teaches the limitations of claim 9, he fails to explicitly teach segmentation is performed using a watershed transformation.

However, in the same field of medical image analysis, Kuhnigk teaches segmentation is performed using a watershed transformation (Paragraph 29: segmentation is performed by means of a watershed transformation).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to perform the segmentation step of Ko using the watershed transformation as taught by Kuhnigk. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because performing a segmentation using a watershed transformation allows for segmentation based on topology, so that areas of interest are segmented properly and do not loose relevant information. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Kuhnigk continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of segmenting an medical image. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

10. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ko in view of Bullitt et al. (U.S. Pub. No.: 2007/0019846, "Bullitt").

1) Regarding Claim 19, while Ko teaches the limitations of claim 18, he fails to explicitly teach wherein the data processing unit is further set up to register the selected object constituents using individually assigned registration methods.

However, in the same field of medical image analysis, Bullitt teaches wherein the data processing unit is further set up to register the selected object constituents using individually assigned registration methods (Paragraph 91: Various registration techniques are used, including a tissue-based correlation).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to configure Ko's data processing such that during the registration process, they are registered using individually assigned registration methods as taught by Bullitt. The determination of obviousness is predicated upon the following findings: one skilled in the art would have been motivated to modify Ko in this manner because using an tissue-based correlation registration method allows for use tissue structure (vessels in the lung) as a way of accurately registration structures in one image (one study) to another image (second study) such that a precise comparison can be made in Ko's teachings. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements in the manner explained above using known engineering design, interface and/or programming techniques, without changing a "fundamental" operating principle of Ko, while the teaching of Bullitt continues to perform the same function as originally taught prior to being combined, in order to produce the repeatable and predictable result of registering object constituents in a medical image. It is for at least the aforementioned reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nirav G. Patel whose telephone number is (571)270-5812. The examiner can normally be reached on Monday - Friday 8 am - 5 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on 571-272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nirav G. Patel/
Examiner, Art Unit 2624

/Brian P. Werner/
Primary Examiner, Art Unit 2624